No of Pages : 4 **08P005**

Roll No:
(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, APRIL - 2013

BE – PRODUCTION ENGINEERING Semester: 6

08P005 FINITE ELEMENT APPLICATIONS IN MANUFACTURING

Time : 3 Hours **Maximum Marks: 100**

INSTRUCTIONS:
1. Group I and Group II questions should be answered in the Main Answer Book.
2. Answer any **6** questions in Group II.
3. Answer **ALL** questions in Group I and Group III.
4. Group III – **Multiple Choice questions** - (which will be given to the candidates half an hour before the scheduled close of the examination) **should be answered only** in the space provided **in the Main Answer Book.**
5. **Suitable assumptions can be made wherever necessary, symbols to be explained, use of design data book /tables NOT permitted**

GROUP I **Marks: 10 x 3 = 30**

1. Present the basic equation for the finite element formulation of metal forming problems in its general form.
2. Sketch a few (2) elements that can be used in solving (a) metal forming problems and (b) metal casting problems. Indicate their DOF with physical meaning.
3. How is velocity boundary condition implemented in FEA of metal forming problems?
4. How is the geometry of a deforming body updated in metal forming problems while solved using FEA?
5. Provide two examples for metal forming processes which are of plane strain type with sketches.
6. Present the weak form of the classical heat conduction equation to analyse a metal casting problem.
7. How can casting-mold interface heat transfer be modeled for the FEA of casting problems?
8. Name a few(3) near net shape manufacturing processes and mention the challenges faced by industries in implementing them.
9. How can filler metal deposition be modeled in simulating welding processes by FEA?
10. What is runner balancing in injection molding? How is this implemented in a software for flow analysis?

GROUP II

Marks: 6 x 10 = 60

11. Interpret the situations in (i) Figure 1(a) which shows a preprocessor for the FEA of a typical metal forming problem. Provide the physical meaning of the definitions. (ii) Figure1 (b) is the postprocessor screen for the last stage of simulation of a metal forming problem. Interpret the result and make suggestion for the observations made.

12. Obtain the expression for strain rate matrix in its general from as needed in the FEA of metal forming processes.

13. Define shape functions as used in FEA and sketch the values of the shape function for a quadrilateral element with 4 nodes. Using this element for a plane strain situation in metal forming, obtain the stiffness equations in the general form.

14. Study the product in Figure 2 and this is to be cast. Identify the critical portions in the casting and provide steps to simulate the solidification of the section using FEA.

15. The product in Figure 3 is made of plastic. Provide a methodology by which the necessary tooling can be developed to produce a quality part with the help of CAE practice.

16. Present the general structure of an FEA based software that can be used to analyse metal forming problems.

17. Identify the challenges in developing tooling for new products in a cost effective manner using the following processes (a) metal casting (b) injection molding (c) and forging. Discuss the use of CAD and CAE in these cases to provide effective solutions to the original equipment manufacturer.

/END/

FD/RL

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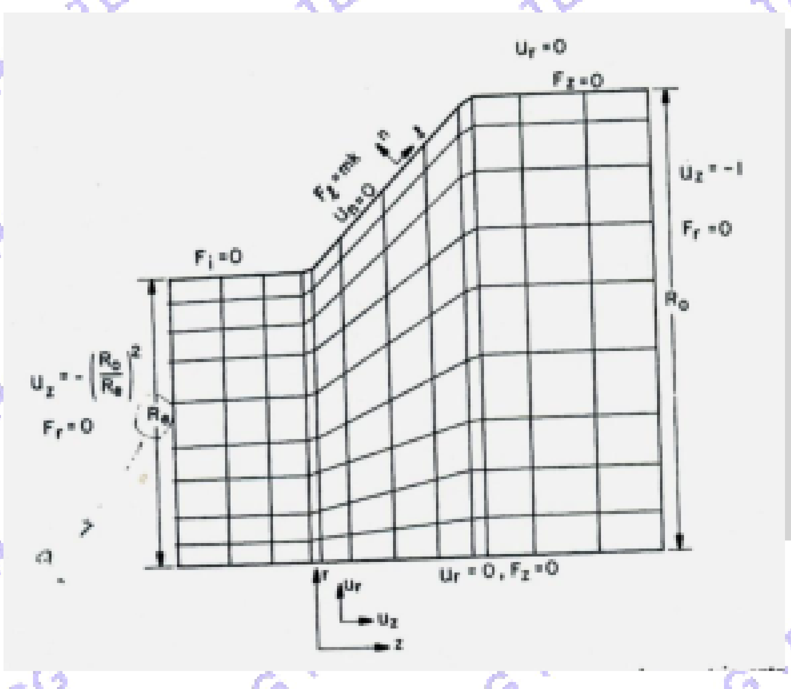


Figure 1 (a) For Qn 11

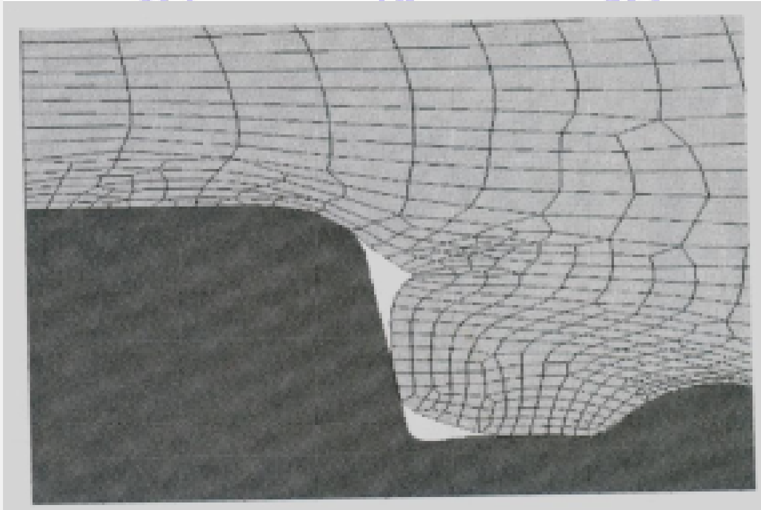


Figure 1 (b) For Qn 11

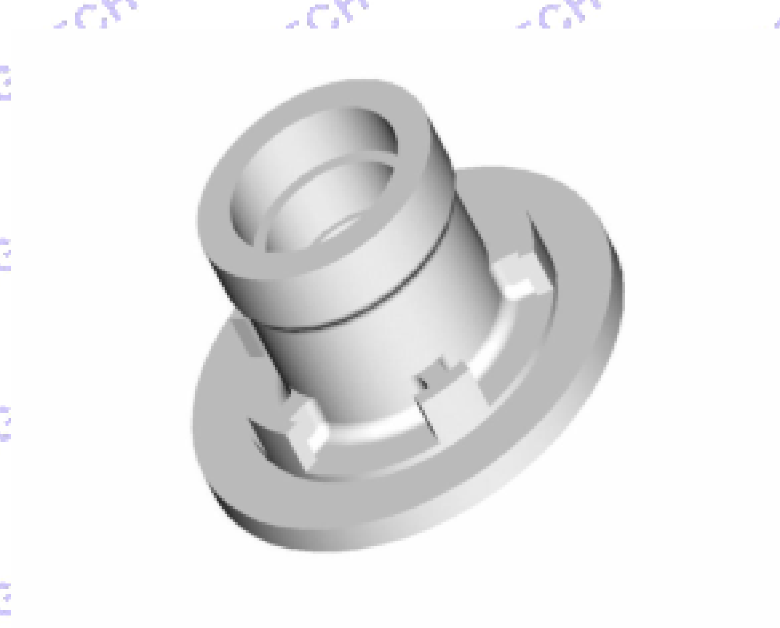


Figure 2 for Qn. No. 14

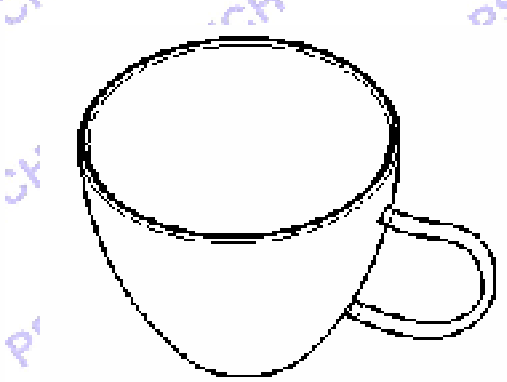


Figure 3 for Qn. No. 15

No of Pages : 4 08P005

Roll No:

Write the Alphabet of your choice answer for each question in the space provided in the Main Answer Book
(Do not attach this question paper along with the Main Answer Book)

APRIL – 2013

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GROUP III **Marks: 10 x 1 = 10**

I) The deformation of a connecting rod while forged is of

A) plane strain **B)** axis-symmetric

C) combination of A and B **D)** plane stress

II) The assumed velocity field in the FEA of a metal forming process has to satisfy

A) boundary conditions **B)** incompressibility condition

C) equilibrium equations **D)** A & B

III) In a three noded triangular element with nodes at the vertices the derivatives of shape function will be

A) constant **B)** zero

C) linear function of coordinates **D)** infinite

IV) In FEA aspect ratio of elements are critical as aspect ratio controls

A) errors **B)** speed of computation

C) variation of property **D)** A & C

V) Heat affected zone in welding can be predicted using

A) Energy equation **B)** continuity equation

C) diffusion equation **D)** flow analysis

VI) Suitable boundary condition/s at the mold -metal interface in solving metal casting problems is

A) equality of temperatures **B)** continuity of heat fluxes

C) radiation boundary condition **D)** A & B

VII) The pressure contours in injection molding analysis will be close when

A) pressure drop is large **B)** pressure drop is small

C) section thikness is uniform **D)** velocity is constant

VIII) A metal part when inserted in an injection mold to produce a a product alters

A) cooling time **B)** flow pattern **C)** stresses **D)** A, B & C

IX) A defect that can be observed from flow analysis of plastic material is

A) weld lines **B)** meld lines **C)** air traps **D)** A, B & C

X) Distortion of a weldment and a casting can be predicted using

A) Thermal analysis **B)** structural analysis

C) Thermo-mechanical analysis **D)** dynamic analysis